



NFT-Based Land Ownership in Minecraft

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Introduction

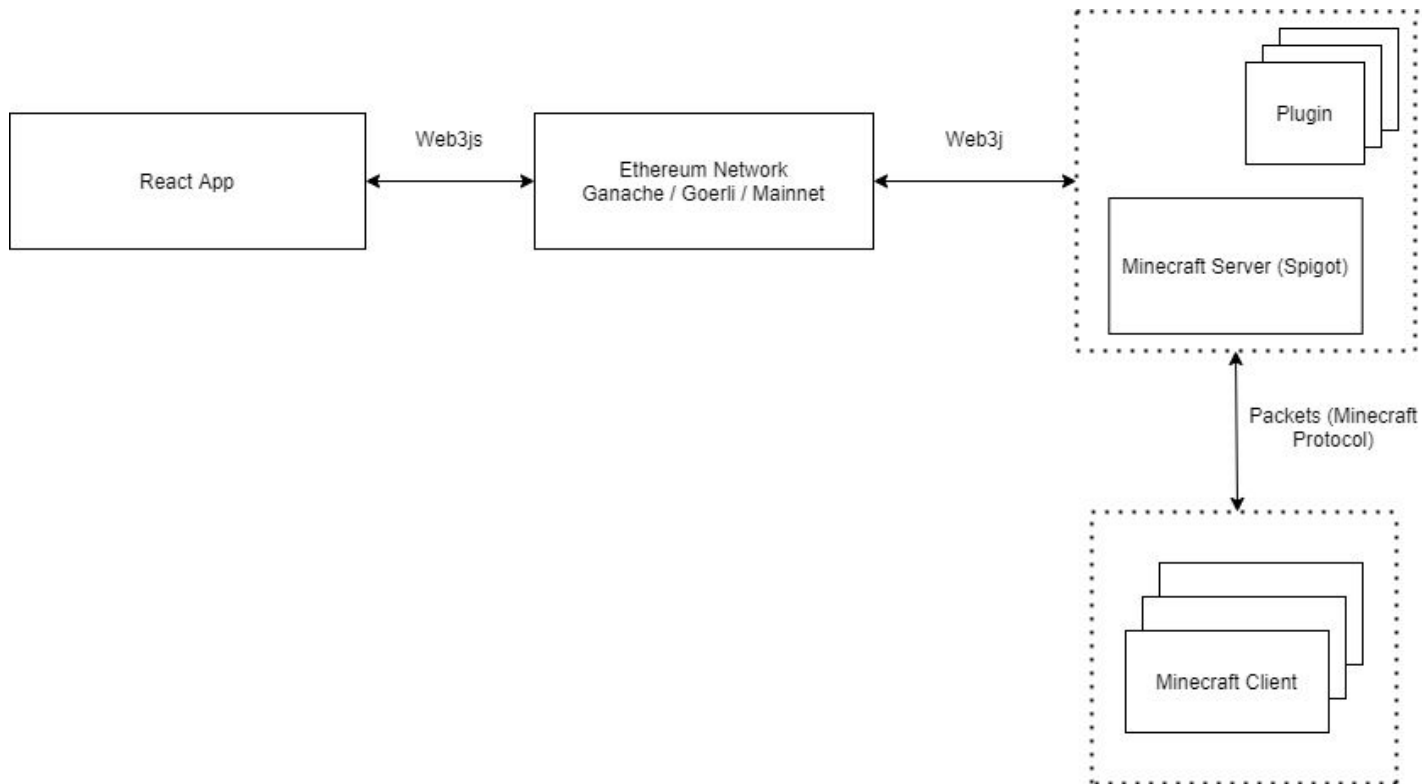
- Minecraft is a 3D sandbox game (XYZ axis)
 - X/Z axis range from [-30 million, 30 million]
 - Y axis ranges from [0, 255-384] depending on the version of the game
- A block is a single point on the XYZ axis
- A chunk is a 16x16 area that spans the Y axis
- Chunks are procedurally generated by the game
- Can do math to find out which chunk (XZ) a block (XYZ) is in



What

- NFT-Based chunk ownership done on a first come first serve basis (no whitelist, no reserved chunks, etc.)
- Players are unable to interact with blocks inside of chunks they don't own
- Three components
 - Smart contract (**Solidity**)
 - ERC721 (Non-Fungible Token Standard)
 - Each token corresponds to a chunk in-game (metadata contains the X/Z coordinate)
 - Unit tests to ensure our code works, unforgiving development environment
 - Minecraft Plugin (**Java**)
 - Allows users to link addresses
 - Prevents interacting with chunks the player does not own
 - Web App (**React**)
 - Allows users to connect MetaMask wallet and “mint”

System Design



Smart Contract

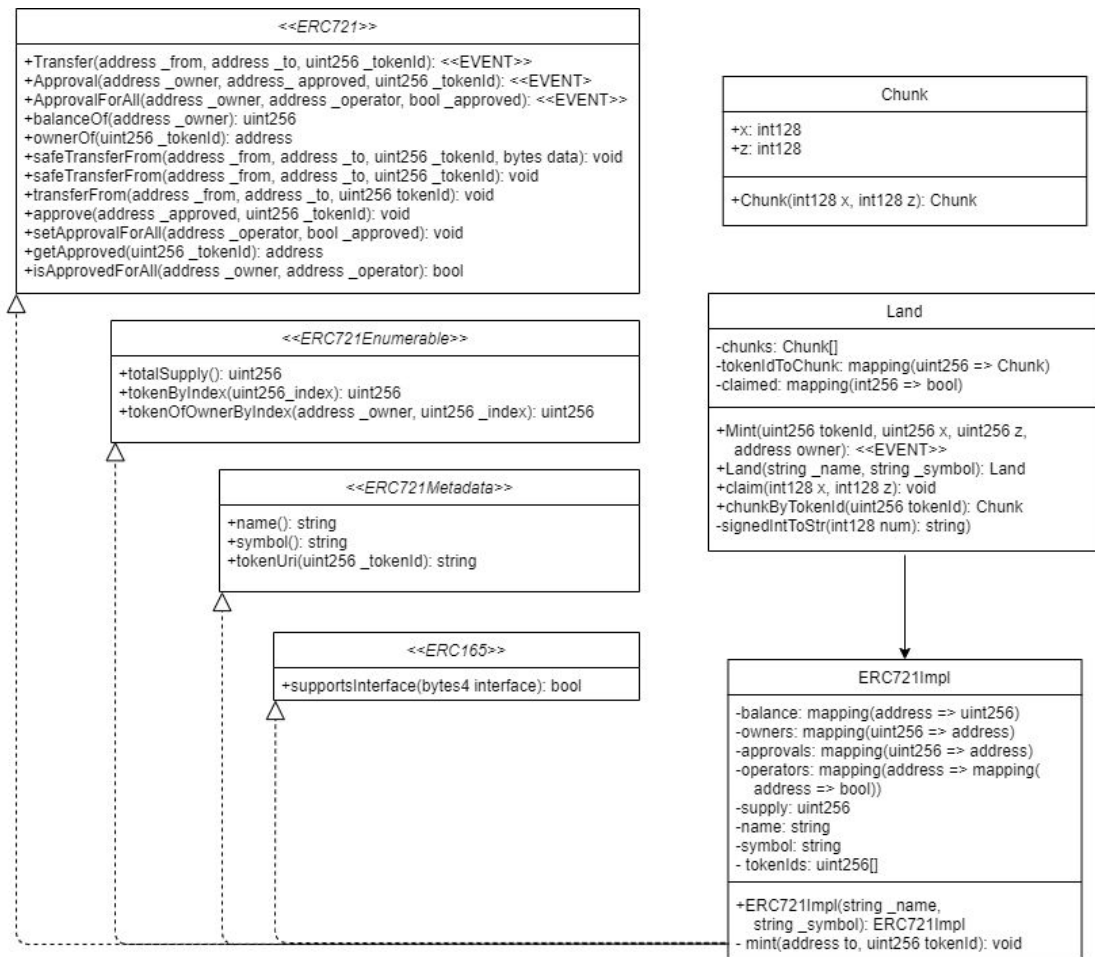
```
abstract contract ERC721Impl is IERC721, IERC721Enumerable, IERC721Metadata {
    mapping(address => uint256) private _balances;
    mapping(uint256 => address) private _owners;
    mapping(uint256 => address) private _approvals;
    mapping(address => mapping(address => bool)) private _operators;
    string private _name;
    string private _symbol;
    uint256 private _supply;
    uint256[] private _tokenIds;
}
```

```
contract Land is ERC721Impl {

    struct Chunk {
        int128 x;
        int128 z;
    }

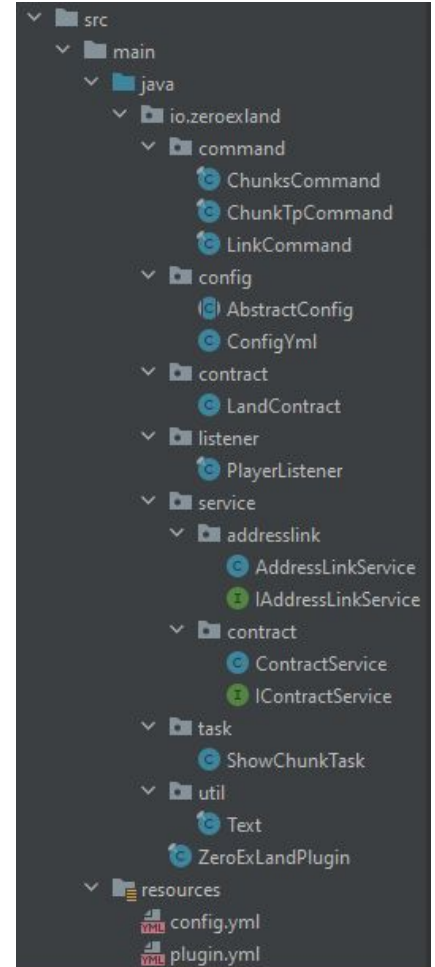
    event Mint(uint256 _tokenId, int128 x, int128 z, address owner);

    mapping(uint256 => Chunk) private _tokenIdToChunk;
    mapping(int256 => bool) private _claimed;
}
```



Minecraft Plugin

- Commands
 - /chunks (Lists owned chunks if an address is linked)
 - /link <address> (Allows linking of an address)
 - /chunktp <x> <z> (Go to the specified chunk)
- Listener
 - Cancel player interacts outside of owned chunks
- Misc.
 - Configurable Web3j params (e.g. - network, gas, etc.)
 - Chunk border visualization



Web App

- Allow users to connect MetaMask wallet
- Allow users to claim chunks



X	0
Z	0
<button>Mint</button>	

Future Work

- Off-chain transaction signing for account linking (Web app -> plugin)
- Dynamically create wallet file (private key) in plugin (plugin read only)
- Better UI/UX
 - Could display events emitted such as Transfer, Approval, Mint, etc.
 - Tab for owned tokens when a wallet is linked

Demo

- Contract deployed on Goerli testnet
- Server / Web App hosted locally

Minecraft Bans NFTs

- <https://www.minecraft.net/en-us/article/minecraft-and-nfts>

To ensure that Minecraft players have a safe and inclusive experience, blockchain technologies are not permitted to be integrated inside our client and server applications, nor may Minecraft in-game content such as worlds, skins, persona items, or other mods, be utilized by blockchain technology to create a scarce digital asset. Our reasons follow.



End

Code: <https://github.com/mlefeb01/OxLand>

